Pilgrims Face Recognition Dataset – HUFRD

Salah A. Aly

Center of Research Excellence in Hajj and Umrah (HajjCore),
College of Computers and Information Systems, Umm Al-Qura University, Makkah, KSA
Email: salahaly@uqu.edu.sa

***Abstract*—In this work, we define a new pilgrims face recognition and face detection dataset, called Hajj and Umrah facial dataset. The new developed dataset presents various pilgrims' images taken from outside the Holy Masjid El-Harram in Makkah during the 2011-2012 Hajj and Umrah seasons. Such dataset will be used to test our developed facial recognition and detection algorithms, as well as in the missing and found recognition system [2].**

I. Introduction

Every year millions of muslims arrive to perform the holy rituals of Hajj and Umarh in Makkah Al-Mokarramah, Kingdom of Saudi Arabia. During these rituals the Saudi authorities save no effort to facilitate the stay of the pilgrims in the kingdom. The greatest challenge is the huge number of missing persons and unidentified deaths every year. So, an efficient monitoring system is essential to provide means of tracking missing and found individuals and identifying them in order to take the necessary actions. To solve this problem, we describe a new pilgrims face recognition dataset, HUFRD, which will be used in the CrowdSensing system for recognizing missing and found people [2], see sample classes of HUFRD in Fig. 1.

Facail recognition is one of the most complex applications in the field of Computer Vision. Developing a computational model of human faces for detection and recognition, though interesting, can prove to be a very challenging task. The rapid progress in PCs' speed certainly assists the operation of face detection and recognition to be done in real-time.

One of the most crucial steps in the CrowdSensing system that we describe in [2] is to how to detect the individual faces in an image and run a face recognition algorithm through a database of registered pilgrims. Therefore, the proposed approach is more focused on developing a pattern detection algorithm that does not depend on the three-dimensional complex data of the face, but it depends on the general outer Silhouette that is almost shared between all faces. Our goal is to develop a computational model for face detection and recognition that is reasonably simple, and acceptably accurate under various conditions of lighting, facial expressions, and background environment.

In general, facial dataset type has a strong effect in face recognition performance, it contains multiple images for each person. Facial datasets depend on several different factors such as:

- Facial expression such as sadness, happiness, and facial pose.
- Occlusion: faces may be partially occluded by other objects (like wearing glasses).
- Imaging conditions like lighting and camera resolution.
- Presence or absence of structural components like beards, mustaches and glasses.

Fig. 1: The new Hajj and Umrah facial recognition dataset presents various images taken outside El-Harram in Makkah [2] 2011-2012 Hajj and Umrah seasons.

Fig. 2: A sample set of Hajj and Umrah Facial Recognition Dataset (1)

II. Pilgrims Face Recognition Dataset

In the Hajj and Umrah face recognition dataset, HUFRD, hundreds of pilgrims images are taken randomly during 2011-2012 Hajj and Umrah seasons. The dataset contains faces from more than 25 countries as shown in Fig. 2. For each person, 6 up to 15 images are taken to define a person's class in the dataset. Further information about this dataset can be found in CrowdSensing project [2].

A. Sample Images of Hajj and Umrah Face Recognition Dataset

The HUFRD contains images taken during the 2011-2012 Hajj and Umrah seasons of a large number of pilgrims (varied races and appearances). It contains at least six images for each individual, in a varied range of poses, facial expressions (open and closed eyes, smiling and not smiling) and facial details (glasses/ no glasses), and in different lighting conditions and against random backgrounds. All images are in full-color JPG format, see Fig. 2 and‘3.

Fig. 3: A sample set of Hajj and Umrah Facial Recognition Dataset (2)

B. CrowdSensing System

The CrowdSensing system is established to support the existing efforts to manage the crowds and solve the missing and found problem during Hajj and Umrah seasons in KSA. The goal of this CrowdSensing system is to use techniques from Computer Vision and Image Processing to develop a portal website for Hajj and Umrah missing and found people [2]. The system requires all pilgrims to register their personal data when they plan to perform Hajj or Umrah.

One application of the proposed dataset is the CrowdSensing system, which consists of three main components, see Fig. 4:

1) A database of all individuals arriving at the kingdom to perform the holy rituals. This database contains all their personal information along with a personal photo, and it can be updated via our web portal.

Fig. 4: MFHajj portal interface website developed by the Crowdsensing.net team. The system consists of data collectors (mobiles, cameras, PCs), main server, search engine, and an alerting system. The system is used to recognize missing and found people during Hajj and Umrah seasons

2) Advanced monitoring cameras scattered around the Grand Mosque in Makkah, airports, hospitals, and all areas of interest.
3) Our proposed face detection & recognition algorithm is to be used for acquiring faces from images captured by the monitoring cameras and use them to identify missing and found individuals [2].

III. Other Face Detection and Recognition Datasets

Some other face recognition research work can be found in [5], [6], [9], [11], [13], and face recognition datasets [3], [4], [8], [12]. We briefly describe a note about each known face recognition datataset such as FAFFE, UMIST, ORL, and FERET.

A. ORL Dataset

The AT&T Database of Faces, (formerly 'The ORL Database of Faces'), see 5. The database was used in the context of a face recognition project carried out in collaboration with the Speech, Vision and Robotics Group of Engineering Department at Cambridge University. There are ten different images of each of 40 distinct subjects. For some subjects, the images were taken at different times, varying the lighting and facial expressions. All images were taken against a dark homogeneous background with the subjects in an upright, frontal position (with tolerance for some side movement). The images are in PGM format. The size of each image is $92x112$ pixels, with 256 grey levels per pixel [3].

B. Japanese Dataset

The Japanese database consists of 10 persons. The images per person vary from 20 to 23, where facial expressions are varying [4], see Fig. 6.

Fig. 5: Samples of facial images: ORL Dataset

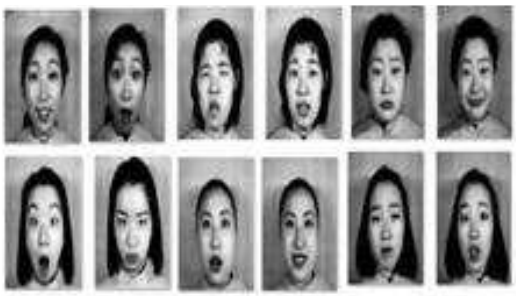

Fig. 6: Samples of facial images: Japanese Dataset

C. UMIST Dataset

The Sheffield (previously UMIST) face database consists of 564 images of 20 individuals (mixed race/gender/appearance). Images are numbered consecutively as they were taken. The images are all in PGM format, approximately $220x220$ pixels with 256-bit grey-scale [8], see Fig. 7.

Fig. 7: Samples of facial images: UMIST dataset

D. FERET

The Face Recognition Technology (FERET) dataset is one of the known face recognition datasets that was collected between 1993 and 1996 and was developed by DARPA [12], see Fig. 8.

E. The Yale Face Dataset

Yale face dataset images should be in grayscale and GIF format [1]. There are 11 different images of each of 15 distinct subjects, these different images mainly depend on different face expressions and little effect of light. For the same subject there are three different images which light is focused in different directions such as center, Lift, Right, and the other 8 images related with person expression like happy, sad, sleepy, Shocked, with or no glasses.

Fig. 8: Samples of facial images: FERET dataset

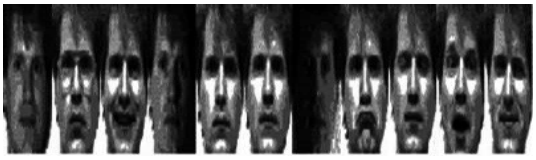

Fig. 9: Samples of facial images: Yale face dataset

F. PIE Dataset

PIE face dataset images in PIE Dataset are colored, it mainly depend on few face expressions, face pose and illumination condition with only one record session. There are 68 distinct subjects and for each subject, there are 13 different poses, 43 different illumination with 4 different expression. [10].

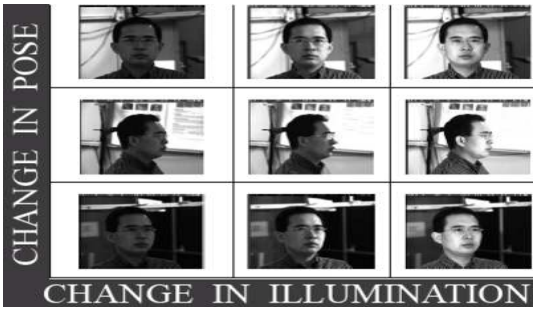

Fig. 10: Samples of facial images: PIE dataset

G. Multi-PIE Dataset

Multi-PIE face dataset images in Multi-PIE Dataset are colored, and mainly depend on face expressions, face pose and illumination condition with multiple record session. There are 377 distinct subjects and for each subject there are 15 different poses, 19 different illumination with 6 different expression with 4 sessions. In both PIE and Multi-PIE, they support a 3D Room with 13 camera. Also, for illumination condition, they support a 3D room with a flash system. Using multiple

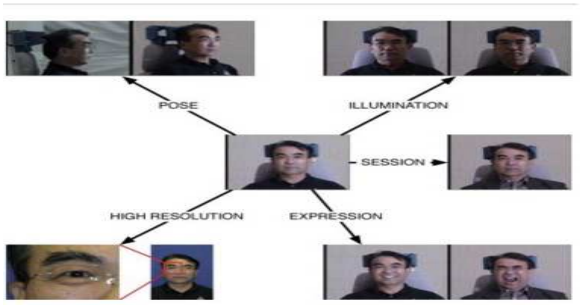

Fig. 11: Samples of facial images: Multi-PIE dataset

cameras which are fixed in specific places in the 3D room save time and efforts for preparing my dataset specially for large dataset as each person in dataset only sits in a chair with and fix his head.

H. AR Face Dataset

AR face dataset images in AR face Dataset are colored, and depend on face expressions such as neutral, smile, anger, scream, also, illumination condition (left, right, center) and occlusions (sun glasses and scarf) with two record sessions during two weeks. There are 126 distinct subjects (over 4,000 color images) divided between man and women (70 men and 56 women) [7].

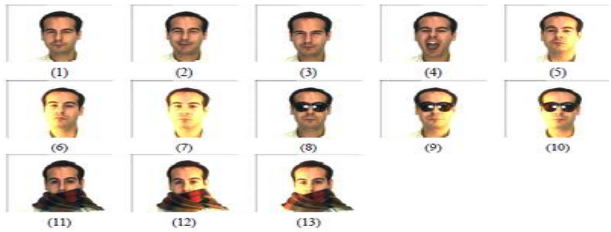

Fig. 12: Samples of facial images: AR face dataset

IV. Discussion and Conclusion

In this note, we have described a new Hajj and Umrah face recognition dataset, HUFRD, for face recognition and face detection. During the huge overcrowds that occur in the two holy cities of Makkah and Madina in KSA every year (more than 5 millions people observe Hajj for at least 10 days), in addition to five millions people observe Umrah throughout the year. The proposed CrowdSensing system can be used to identify missing, found, and dead parsons. Further details about this system can be found in the project website [2].

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TABLE I: Information about ORL, UMIIST, Japanese, FERET, HUFRD datasets

dataset	# persons	# images
ORL	40 persons,	Each has 10 images
UMIST	20 persons,	vary from 19 to 48
JAFFE	10 persons,	vary from 20 to 23
FERET	too many	many
HUFRD	too many	each has at least 6 to 15
Yale face	15 persons	each has 11 images
PIE	68 persons	each has 60 images
Multi-PIE	337 persons	each has 40 images for one session
AR face	126persons	each has 26 images

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References

[1] http://cvc.yale.edu/projects/yalefaces/yalefaces.html. Sep 10,1997.
[2] www.crowdsensing.net. Copyright, 2011.
[3] AT&T Laboratories Cambridge. Database of faces, (formerly 'the orl database of faces'), available: http://www.cl.cam.ac.uk/research/dtg/attarchive/facedatabase.html.
[4] Kyushu University Psychology Department. The japanese female facial expression (jaffe) database, available: http://www.kasrl.org/jaffe.html.
[5] Pallavi Vaidya Divya Jyoti, Aman Chadha and M. Mani Roja. A robust, low-cost approach to face detection and face recognition. *International Journal of Digital Image Processing*, 2011.
[6] D. Jyoti, A. Chadha, P. Vaidya, and M. Mani Roja. A robust, low-cost approach to face detection and face recognition. *CiiT International Journal of Digital Image Processing,*, 15(10), October, 2011.
[7] A Martinez and R Benavente. The AR Face Database. In *ComputerVision Center(CVC) Technical Report*, February 1999.
[8] The University of Sheffield. The umist face database, available: http://www.sheffield.ac.uk/eee/research/iel/research/face. 1998.
[9] J. Malik S. Belongie and J. Puzicha. Shape matching and object recognition using shape contexts. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, April 2002.
[10] S Sim, T.Baker and M Bsat. The CMU Pose, Illumination, and Expression Database. In *lIEEE Transactions on Pattern Analysis and Machine Intelligence*, 2003.
[11] D. Garg Singh. Soft computing. *Allied Publishers*, 2005.
[12] Viola and Jones. Rapid object detection using boosted cascade of simple features. *Computer Vision and Pattern Recognition*, 2001.
[13] J. Yang, D. Zhang, and A.F. Frangi. Two-dimensional pca: A new approach to appearance-based face representation and recognition. *IEEE Transaction on Pattern Analysis and Machine Intelligence*, 26(1):131–137, 2004.

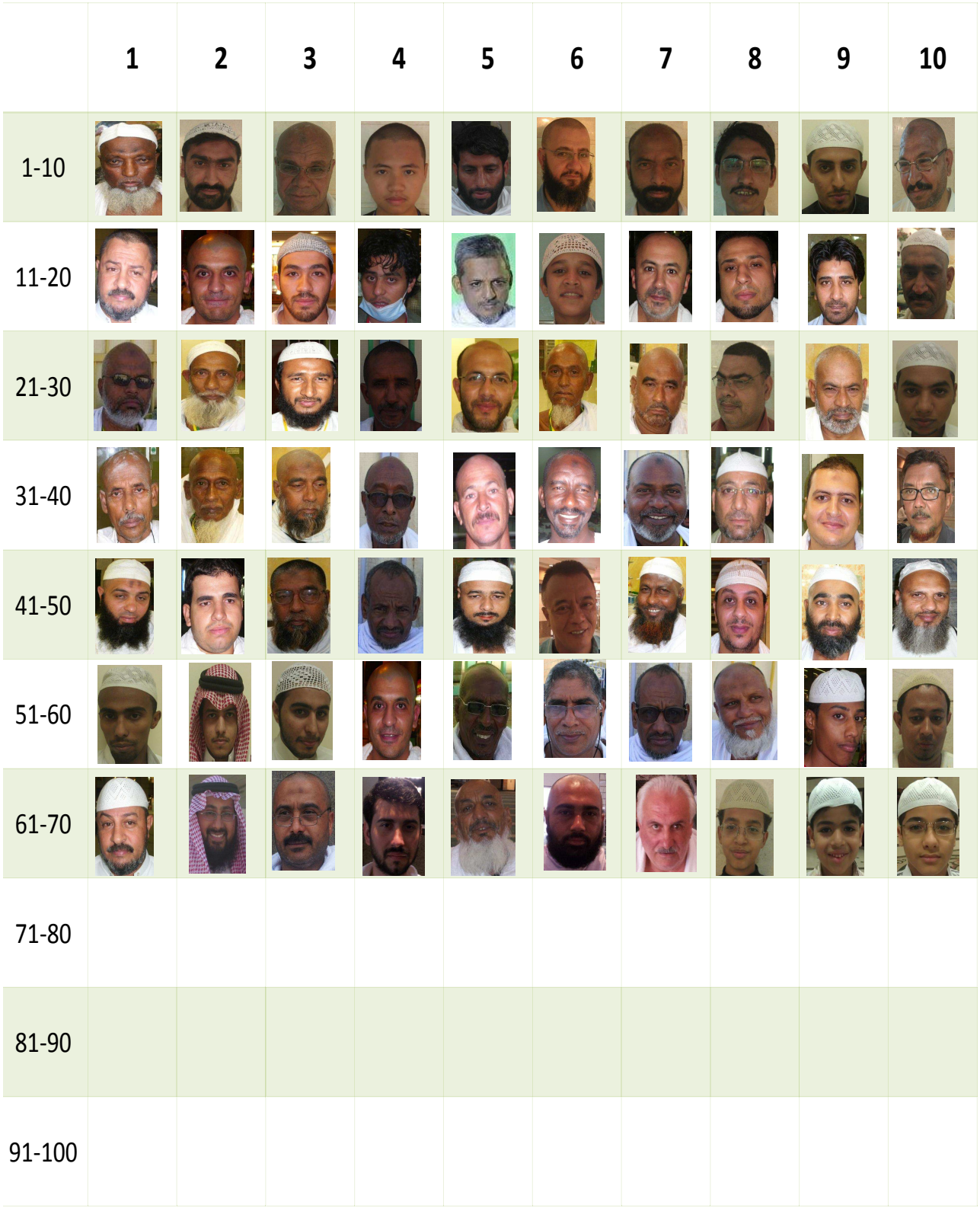

Fig. 13: Pilgrims facial dataset (HUFRD) for face detection and recognition